In this chapter, we focus on the chosen methods of classifier hybridization. Firstly, we present a special case of static classifier selection approaches leading to the combined classifier based on feature space partitioning and assigning a chosen classifier to each partition. Meanwhile, we discuss how to train it and then shortly discuss its quality. Afterwards, we concentrate on a case of binary classification tasks called one-class classification, which is able to train a classifier in the absence of counterexamples, and we trash the problem out by considering how to produce combined classifier for multi-class and one-class classification tasks. Next, an important topic devoted to classification systems for imbalanced data is mentioned. Also, we shortly mention the last topic related to the data stream classification which nowadays seems to be a crucial classification task. Finally, We introduce the problem about how to employ methods presented in the previous chapters, to the classification task where the data probability characteristics are changing during classifier exploitation. This phenomena, called concept drift, has usually a negative impact on classification quality.

4.1 Feature Space Splitting

In the first topic, we present a combined classifier based on feature space partitioning, and for each partition one classifier is assigned to make a decision in the whole classification system. Such an approach is rather intuitive and comprehensible from practical point of view. Let’s pose an example for the medical domain. If we are ill then we usually ask a family doctor for help. If she/he is competent in the domain related to our disorders (competent in a given region of a feature space corresponding to our symptoms), then the physician is able to make a decision about our disorder and take a therapeutic action. Otherwise, no further positive action would be effectively taken if the family doctor is not competent, i.e., the competence area our symptoms belong to where her/his competencies are weak, then the physician refers us
to a specialist from a domain where our symptoms mostly fit, e.g., to cardiologist. The simple example which illustrates the intuition for this approach is presented in Fig. 4.1. Two binary classifiers are presented, and the classification qualities for a whole feature space are not so high. However, each of them is very competent for a particular feature space region.

Fig. 4.1 Illustrative example of two binary classifiers which has local competencies for different feature space partitions